Survey of the Status of Black Redhorse (*Moxostoma duquesnei*), and Spotted Gar (*Lepisosteus oculatus*), in Canada, 2002

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SURVEY OF THE STATUS OF BLACK REDHORSE (*Moxostoma duquesnei*), AND SPOTTED GAR (*Lepisosteus oculatus*), IN CANADA, 2002

by

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TABLE OF CONTENTS

TABLE OF CONTENTS III
ABSTRACT V
RÉSUMÉ V
SECTION 1 – BLACK REDHORSE 1
1.0 INTRODUCTION 1
2.0 METHODS 1
2.1 BOAT ELECTROFISHING (BEF) 1
2.2 BACKPACK ELECTROFISHING (BPEF) 2
3.0 RESULTS 9
3.1 FISH ASSEMBLAGE SAMPLING 9
3.2 BLACK REDHORSE DETECTION 9
4.0 DISCUSSION AND RECOMMENDATIONS 11
SECTION 2 – SPOTTED GAR 12
1.0 INTRODUCTION 12
2.0 METHODS 12
2.1 ACTIVE SAMPLING 13
2.2 PASSIVE SAMPLING 13
3.0 RESULTS 18
3.1 FISH ASSEMBLAGE SAMPLING 18
3.2 SPOTTED GAR DETECTION 18
4.0 DISCUSSION AND RECOMMENDATIONS 20
5.0 ACKNOWLEDGEMENTS 21
6.0 REFERENCES 21

LIST OF FIGURES

Figure 1.1 – Sites sampled for the black redhorse in the lower Grand River watershed in 2002. See Appendix 1.1 for detailed site descriptions.....3
Figure 1.2 – Sites sampled for the black redhorse in the upper Grand River watershed in 2002. See Appendix 1.1 for detailed site descriptions.....4
Figure 1.3 – Sites sampled for the black redhorse in the upper Thames River watershed in 2002. See Appendix 1.1 for detailed site descriptions.....5
Figure 1.4 – Sites sampled for the black redhorse in Big Otter Creek in 2002. See Appendix 1.1 for detailed site descriptions.....6
Figure 1.5 – Sites sampled for black redhorse in Catfish Creek in 2002. See Appendix 1.1 for detailed site descriptions.....7
Figure 1.6 – Sites sampled for black redhorse in the Bayfield and Maitland rivers in 2002. See Appendix 1.1 for detailed site descriptions.....8
Figure 2.1 – Overview map of three locations sampled in the spotted gar status survey in 2002.....14
Figure 2.2 – Sites sampled at Long Point for spotted gar in 2002. See Appendix 2.1 for more detailed site descriptions.....15
Figure 2.3 – Sites sampled at Rondeau Bay for spotted gar in 2002. See Appendix 2.1 for more detailed site descriptions.....16
Figure 2.4 – Sites sampled at Point Pelee National Park for spotted gar in 2002. See Appendix 2.1 for more detailed site descriptions.....17

LIST OF TABLES

Table 1.1 – Summary of effort for black redhorse sampling in 2002. Mean effort (±standard deviation) was used due to a lack of effort data for 9 BPEF sites.....9
Table 1.2 – Summary of sampling success for black redhorse by site in five of the eight locations sampled in the 2002.....10
Table 1.3 – Summary of species presence (% of sites) collected during black redhorse status sampling in 2002.....10
Table 2.1 – Summary of sampling effort for spotted gar in 2002.....18
Table 2.2 – Summary of sampling success for spotted gar by locations sampled in 2002.....18
Table 2.3 – Summary of species presence (% of sites) collected during spotted gar sampling in 2002.....19

LIST OF APPENDICES

Appendix 1.1 – Descriptions of sites sampled for black redhorse in 2002.....22
Appendix 1.2a – Species collected by boat electrofishing at sites sampled in 2002.....24
Appendix 1.2b – Species collected by backpack electrofishing at sites sampled in 2002.....26
Appendix 1.3 – Summary of effort by site sampled in 2002.....30
Appendix 1.4 – Habitat data for black redhorse sites sampled in 2002.....32
Appendix 2.1 – Location descriptions for spotted gar sampling in 2002.....34
Appendix 2.2 – Summary of effort by site sampled in 2002.....35
Appendix 2.3a – Species collected by active sampling at sites sampled in 2002.....36
Appendix 2.3b – Species collected by passive sampling at sites sampled in 2002.....38
Appendix 2.4 – Habitat data for spotted gar sites sampled in 2002.....39

ABSTRACT

Surveys for black redhorse (*Moxostoma duquesnei*) and spotted gar (*Lepisosteus oculatus*), both Threatened fish species, were undertaken by Fisheries and Oceans Canada during the summer of 2002 to determine their current status at sites where they had been historically present. Boat electrofishing, backpack electrofishing, fyke netting and trap netting were used during the sampling. At sites where they were historically present, black redhorse were captured at 2 of 7 Thames River sites (the Middle Thames River and Medway Creek), all 3 Maitland River sites (including Belgrave Creek), and 4 of the 7 Grand River sites. They were also caught at the following sites where they were not collected historically: in 3 of 14 Nith River sites; and, 1 of 2 Conestoga River sites. The spotted gar was detected at 13 sites: 7 sites in Rondeau Bay; and, 6 sites in Point Pelee National Park.

RÉSUMÉ

Des études sur le suceur noir (*Moxostoma duquesnei*) et le lépisosté tacheté (*Lepisosteus oculatus*), deux espèces de poissons menacées, ont été effectuées par Pêches et Océans Canada au cours de l'été 2002 afin de déterminer leur état actuel aux sites où ils sont habituellement présents. La pêche électrique en bateau, la pêche électrique au moyen de sacs à dos, les verveux et les trappes en filet ont été utilisés lors de l'échantillonnage. Aux sites où ils sont habituellement présents, les suceurs noirs ont été capturés à 2 des 7 sites de la rivière Thames (au milieu de la rivière Thames et au ruisseau Medway), aux 3 sites de la rivière Maitland (y compris le ruisseau Belgrave), et à 4 des 7 sites de la rivière Grand. Ils ont également été capturés aux sites suivants où ils ne sont pas habituellement recueillis : à 3 des 14 sites de la rivière Nith; et, à 1 des 2 sites de la rivière Conestoga. Le lépisosté tacheté a été décelé aux 13 sites : aux 7 sites dans la baie Rondeau; et, aux 6 sites au parc national de la Pointe-Pelée.

SECTION 1 – BLACK REDHORSE

1.0 INTRODUCTION

The black redhorse (*Moxostoma duquesnei)* is listed by COSEWIC[1] as Threatened in Canada. The black redhorse has historically been collected in several watersheds in southern Ontario, including the Bayfield River, Catfish Creek, Grand River and its tributaries, Maitland River, Lake Erie tributaries, and the Thames River and its tributaries (Reid and Mandrak 2005). Between July 2 and October 24 2002, a survey of black redhorse status was conducted by Fisheries and Oceans Canada in southern Ontario. Sampling was conducted in the Bayfield River, Big Otter Creek, Catfish Creek, Grand River (including the Conestoga River and Nith River), Maitland River (including Belgrave Creek), and the Thames River (including Fish Creek, Medway Creek, Middle Thames River and Waubuno Creek) (Appendix 1.1). A total of 45 sites were sampled within these locations (Figures 1.1 – 1.6).

2.0 METHODS

Sites were selected based on where black redhorse have been collected historically, from records at the Royal Ontario Museum (Figures 1.1 – 1.6, Appendix 1.1). All sites sampled in this study involved electrofishing. Ten sites were sampled using a boat electrofishing (BEF) unit (single boom, 4.57 m boat equipped with a Smith-Root 5.0 GPP, a 5.0 kW generator, and three foot pedals). The remaining 35 sites were sampled using a backpack electrofishing (BPEF) unit (Smith Root LR 24 Backpack Unit). BEF methods were used at 4 of the 14 Nith River sites, all 4 sites in Big Otter Creek, and 2 of 8 Catfish Creek sites.

2.1 BOAT ELECTROFISHING (BEF)

Active sampling efforts by the boat electrofishing unit ranged from 929 to 1613 seconds of shocking at each site (Appendix 1.3). The mean sampling effort at each site (± STD) was 1080.8 ± 204.1 seconds (Table 1.1). Upon completion of electrofishing, fishes were identified, measured and returned to the water. Voucher specimens of each species were preserved in 10% formalin for identification in the laboratory. Voucher

[1] Committee on the Status of Endangered Wildlife in Canada

specimens were then sent to the Royal Ontario Museum for further verification and cataloguing or discarding.

2.2 BACKPACK ELECTROFISHING (BPEF)

Active sampling efforts by the backpack electrofishing unit ranged from 380 to 4300 seconds of shocking at each site. Mean sampling effort at each site was 1475.5 ± 996.2 seconds (Table 1.1, Appendix 1.3). Upon completion of electrofishing, fish were identified, measured, and returned to the water. Voucher specimens of each species were preserved in 10% formalin for identification in the laboratory. Voucher specimens were then sent to the Royal Ontario Museum for further verification and cataloguing or discarding.

Figure 1.1 – Sites sampled for the black redhorse in the lower Grand River watershed in 2002. See Appendix 1.1 for detailed site descriptions.

Figure 1.2 – Sites sampled for the black redhorse in the upper Grand River watershed in 2002. See Appendix 1.1 for detailed site descriptions.

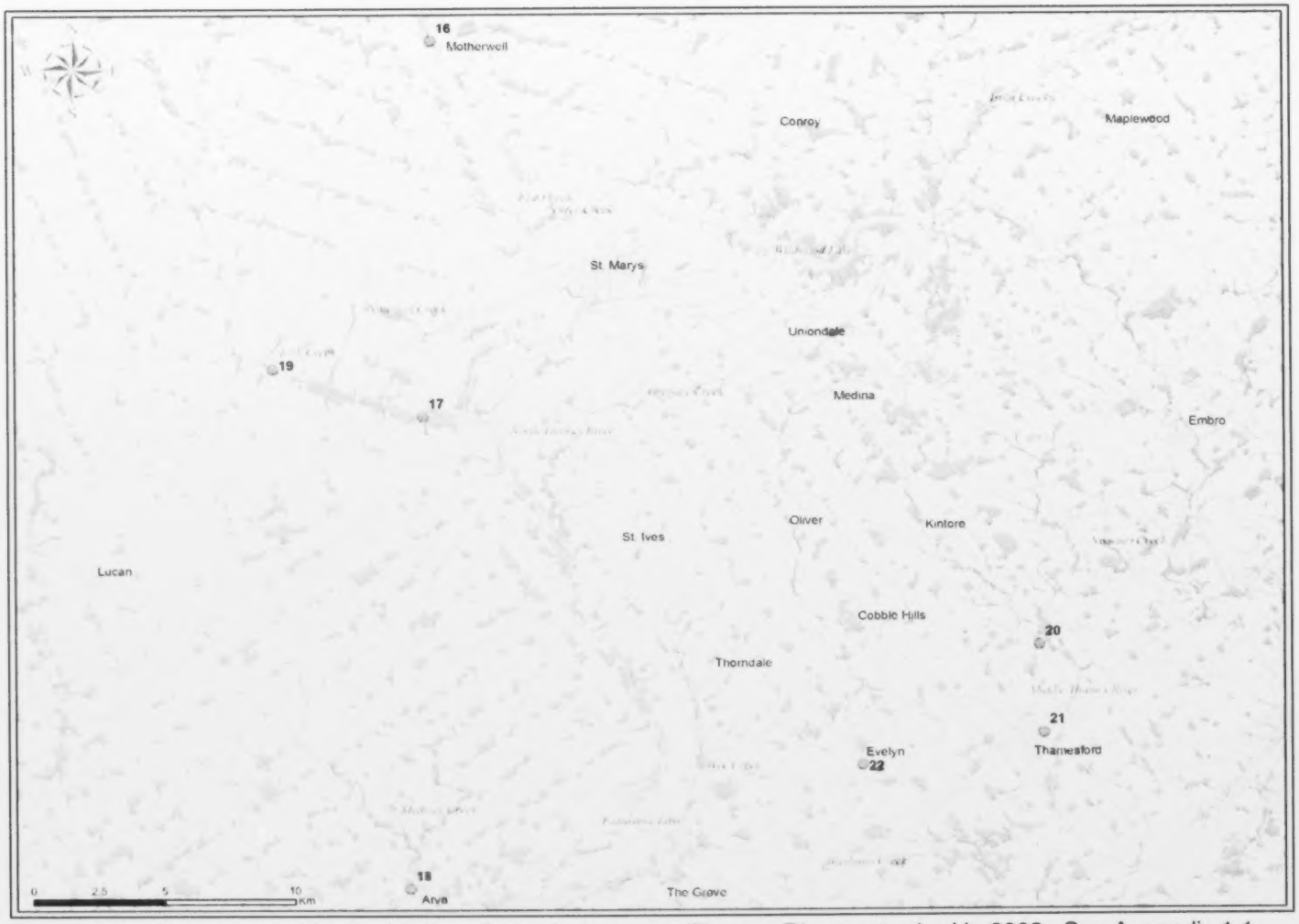

Figure 1.3 – Sites sampled for the black redhorse in the upper Thames River watershed in 2002. See Appendix 1.1 for detailed site descriptions.

Figure 1.4 – Sites sampled for the black redhorse in Big Otter Creek in 2002. See Appendix 1.1 for detailed site descriptions.

Figure 1.5 – Sites sampled for black redhorse in Catfish Creek in 2002. See Appendix 1.1 for detailed site descriptions.

Figure 1.6 – Sites sampled for black redhorse in the Bayfield and Maitland rivers in 2002. See Appendix 1.1 for detailed site descriptions.

3.0 RESULTS

3.1 FISH ASSEMBLAGE SAMPLING

Through a combination of BEF and BPEF sampling techniques, a total of 1154 fishes were captured, representing 54 species (Table 1.1). Of these, one Species at Risk (SAR), as listed by COSEWIC, was detected: black redhorse (Appendix 1.2). BEF sampling efforts detected 31 fish species (Table 1.1, Appendix 1.2a). BPEF sampling efforts detected 51 species, including black redhorse (Table 1.1, Appendix 1.2b).

Table 1.1 – Summary of effort for black redhorse sampling in 2002. Mean effort (±standard deviation) was used due to a lack of effort data for 9 BPEF sites. *Unidentified *Notropis* and *Nocomis* species were not considered as distinct species for species richness calculations. **CPUE is based on the mean effort values shown in the table.

	BEF	BPEF	Combined Gears
Total Fish Captured	457	597	1154
Species Richness	31*	51*	54*
Fish SAR detected (#)	0	1	1
Total Effort (minutes)	180.1	NA	NA
Mean Effort (minutes ± standard deviation)	18.0 ± 3.4	24.6 ± 16.6	22.8 ± 14.5
Mean CPUE (fish/hour)	25.4**	24.3**	50.6**

3.2 BLACK REDHORSE DETECTION

Black redhorse were collected at 13 sites, all of which were sampled using BPEF methods. The sites were distributed throughout the sampling locations. Of the historical sites that were resampled, 2 of 7 Thames River sites (the Middle Thames River and Medway Creek), all 3 Maitland River sites (including Belgrave Creek), and 4 of the 7 Grand River sites yielded specimens of black redhorse (Table 1.2, Appendix 1.2b). Of the additional locations sampled, black redhorse were collected at 3 of 14 Nith River sites and 1 of 2 Conestoga River sites. None of the sites sampled by BEF methods yielded black redhorse (Table 1.3, Appendix 1.2a), and none were collected in the Bayfield River, Catfish Creek or Big Otter Creek (Appendix 1.2a and b).

Table 1.2 – Summary of sampling success for black redhorse by site in five of the eight locations sampled in the 2002. *Due to insufficient effort data for some sites, Mean Effort (± standard deviation) was calculated and used in lieu of Total Effort in calculating CPUE.

	All	Grand River	Maitland River	Thames River	Conestoga River	Nith River
Total black redhorse	**80**	55	8	7	1	9
Sites with black redhorse	**13**	4	3	2	1	3
Mean Effort (±St.Dev.) (min.)	**24.4 ± 12.3**	34.9 ± 13.7	19.8 ± 3.8	22.6 ± 4.5	46.7 ± 0.0	11.5 ± 0.0
CPUE (fish/min.)	**3.28**	1.58	0.40	0.31	0.02	0.78

Table 1.3 – Summary of species presence (% of sites) collected during black redhorse status sampling in 2002. Scientific and common names according to Nelson *et al.* 2004. COSEWIC status: T-Threatened.

Common Name	Scientific Name		BEF sites	BPEF sites
black crappie	*Pomoxis nigromaculatus*		0	5.7
black redhorse	*Moxostoma duquesnei*	T	0	37.1
blacknose dace	*Rhinichthys atratulus*		10	8.6
blacknose shiner	*Notropis heterolepis*		0	2.8
blackside darter	*Percina maculata*		50	17.1
bluegill	*Lepomis macrochirus*		0	5.7
bluntnose minnow	*Pimephales notatus*		20	34.3
brook trout	*Salvelinus fontinalis*		0	2.9
brown bullhead	*Ameiurus nebulosus*		0	2.9
central stoneroller	*Campostoma anomalum*		0	20
channel catfish	*Ictalurus punctatus*		50	8.6
Chinook salmon	*Oncorhynchus tshawytscha*		0	2.9
common carp	*Cyprinus carpio*		10	17.1
common shiner	*Luxilus cornutus*		0	34.3
creek chub	*Semotilus atromaculatus*		30	22.9
emerald shiner	*Notropis atherinoides*		20	0
fantail darter	*Etheostoma flabellare*		0	8.6
gizzard shad	*Dorosoma cepedianum*		30	8.6
golden redhorse	*Moxostoma erythrurum*		50	25.7
golden shiner	*Notemigonus crysoleucas*		0	5.7
greater redhorse	*Moxostoma valenciennesi*		0	25.7
green sunfish	*Lepomis cyanellus*		20	0
greenside darter	*Etheostoma blennioides*		40	42.9
hornyhead chub	*Nocomis biguttatus*		10	28.6

Table 1.3 – Continued.

Common Name	Scientific Name	BEF sites	BPEF sites
johnny darter	*Etheostoma nigrum*	30	20
largemouth bass	*Micropterus salmoides*	0	11.4
least darter	*Etheostoma microperca*	0	2.9
logperch	*Percina caprodes*	0	2.9
longear sunfish	*Lepomis megalotis*	0	14.3
longnose dace	*Rhinichthys cataractae*	30	17.1
longnose gar	*Lepisosteus osseus*	0	5.7
mimic shiner	*Notropis volucellus*	30	11.4
mottled sculpin	*Cottus bairdii*	0	2.9
northern hog sucker	*Hypentelium nigricans*	60	42.9
northern pike	*Esox lucius*	0	2.9
pearl dace	*Margariscus margarita*	0	2.9
pumpkinseed	*Lepomis gibbosus*	0	14.3
quillback	*Carpiodes cyprinus*	20	2.9
rainbow darter	*Etheostoma caeruleum*	40	37.1
river chub	*Nocomis micropogon*	20	20
rock bass	*Ambloplites rupestris*	60	54.3
rosyface shiner	*Notropis rubellus*	30	25.7
round goby	*Neogobius melanostomus*	0	2.9
shorthead redhorse	*Moxostoma macrolepidotum*	30	11.4
silver redhorse	*Moxostoma anisurum*	40	11.4
smallmouth bass	*Micropterus dolomieu*	40	48.6
spotfin shiner	*Cyprinella spiloptera*	50	11.4
spottail shiner	*Notropis hudsonius*	10	0
stonecat	*Noturus flavus*	20	17.1
striped shiner	*Luxilus chrysocephalus*	30	25.7
unidentified	*Nocomis sp.*	10	0
unidentified	*Notropis sp.*	10	0
white sucker	*Catostomus commersonii*	70	48.6
yellow perch	*Perca flavescens*	0	8.6

4.0 DISCUSSION AND RECOMMENDATIONS

Black redhorse, were collected at 13 of 45 sites sampled, all of which were sampled using BPEF sampling methods (Tables 1.2, 1.3, Appendix 1.2b). It appears that BPEF sampling methods may be more effective in detecting black redhorse; however, these results do not allow for the comparison of BEF and BPEF sampling techniques in terms of their fish SAR sampling efficiency; since only one sampling

method was employed at any given location or waterbody. Therefore, differences in sampling efficiency may simply be due to the non-random distribution of fish SAR.

Total fish captured and mean CPUE indicates that the BEF and BPEF methods contributed equally to total sampling efficiency (Table 1.1). Black redhorse CPUE was highest in the Grand River (about 2 times higher than in the Nith River and more that 4 times higher than in the other waterbodies where black redhorse were detected).

Several historical records including those for the Grand River, Maitland River and Thames River have been extended in this study, while new records have been established in the Nith and Conestoga rivers. Black redhorse was not detected in the Bayfield River or Catfish Creek where historic records exist, indicating a possible reduction in the species' distribution.

Further studies, implementing more comprehensive sampling tools, should continue in order to elucidate the distribution and abundance of black redhorse in Canada. It would also be beneficial to use a larger variety of sampling gears at each site in order to determine the differences in gear efficiency in capturing black redhorse.

SECTION 2 – SPOTTED GAR

1.0 INTRODUCTION

The spotted gar (*Lepisosteus oculatus)* is listed by COSEWIC as a Threatened species in Canada. The spotted gar has a very limited distribution in southern Ontario; historical data indicate the presence of this species in Lake Erie (Rondeau Bay, Long Point Bay and Point Pelee) and the Sydenham River, a tributary of Lake St. Clair (Mandrak and Cudmore 2005). Between June 18 and August 22, 2002, a survey of spotted gar was conducted by Fisheries and Oceans Canada at several locations in Lake Erie, including Long Point, Rondeau Bay and Point Pelee National Park (PPNP). A total of 28 sites were sampled within these locations (Figures 2.1-2.4, Appendix 2.1).

2.0 METHODS

Sampling gear used in this study can be categorized as either active or passive gear. Active sampling was conducted using a boat electrofishing unit (14' Electrofishing Boat, Smith-Root 5.0 kW GPP). Passive sampling was conducted using a variety of netting techniques, including fyke nets of two different mesh sizes (small 6 mm; large 25 mm), and a 1.22 m trap net. Of the 28 sites sampled during this study, 19 were sampled

using electrofishing techniques (all in Rondeau Bay), and the other sites were sampled with small-mesh fyke nets (4), large-mesh fyke nets (1), or a trap net (4) (Appendix 2.2). Sites located in Long Point (including Big Creek Marsh and Old Cut Marsh) and Rondeau bays were actively sampled, while PPNP sites were passively sampled.

2.1 ACTIVE SAMPLING

Active sampling efforts by the boat electrofishing unit ranged from 443 to 3686 seconds of shocking (Appendix 2.2). Upon completion of electrofishing, fishes were identified, measured and returned to the water. Voucher specimens of each species were taken and preserved in 10% formalin for verification in the laboratory. Voucher specimens were then sent to the Royal Ontario Museum for further verification and cataloguing or discarding.

2.2 PASSIVE SAMPLING

Two types of fyke nets and a trap net were used to collect fishes at several of the sites sampled. Fyke nets with large-mesh (LFN) and fyke nets with small-mesh (SFN) were both used, but SFN were used more often than LFN. The fyke nets had a maximum diameter of 1.1 m and were placed in water as shallow as the top of the throat (~0.6 m). Trap nets were fished in deeper water (>1.5 m) as they needed to be submerged. In all passive sampling sites, the various nets were set in place and left for approximately 20 to 26 hours (Appendix 2.2). Once the time had elapsed, the nets were retrieved and captured fishes were identified, measured and returned to the water. Voucher specimens of each species were taken and preserved in 10% formalin for verification in the laboratory. Voucher specimens were then sent to the Royal Ontario Museum for further verification and cataloguing or discarding.

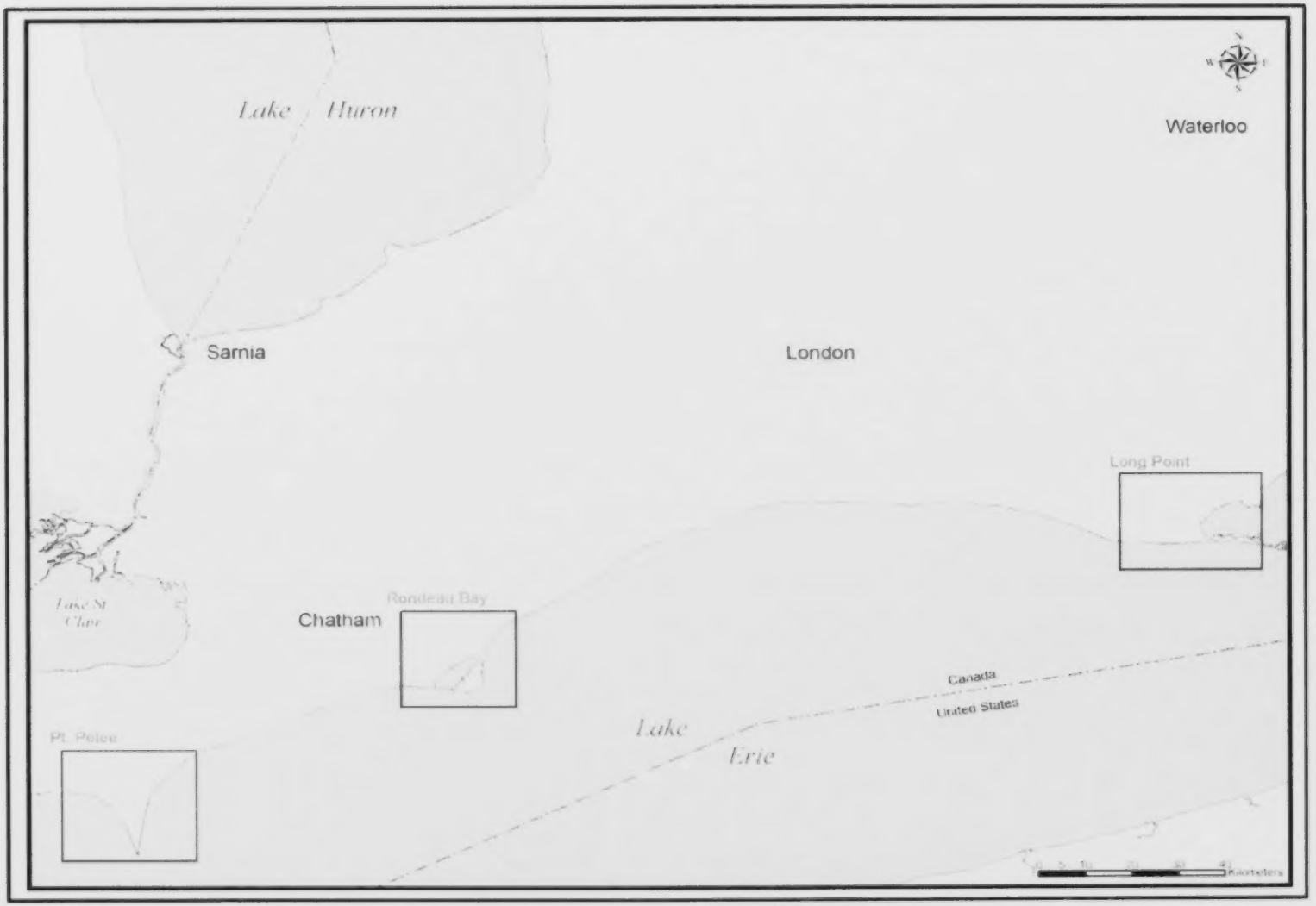

Figure 2.1 – Overview map of three locations sampled in the spotted gar status survey in 2002.

Figure 2.2 – Sites sampled at Long Point for spotted gar in 2002. See Appendix 2.1 for more detailed site descriptions.

Map Legend:

Number on Map	Field Number	Latitude	Longitude	Waterbody Name
1	SPGR02-BCMR-001	42.59680	-80.46749	Big Creek Marsh
2	SPGR02-BCMR-002	42.59362	-80.47065	Big Creek Marsh
3	SPGR02-BCMR-003	42.59694	-80.49005	Big Creek Marsh
4	SPGR02-BCMR-004	42.58931	-80.45493	Big Creek Marsh
5	SPGR02-BCMR-005	42.59987	-80.44990	Big Creek Marsh
6	SPGR02-OLCT-001	42.59409	-80.39575	Old Cut Marsh
7	SPGR02-OLCT-002	42.59339	-80.40826	Old Cut Marsh
8	SPGR02-OLCT-003	42.58197	-80.41460	Old Cut Marsh
9	SPGR02-OLCT-004	42.58384	-80.40697	Old Cut Marsh

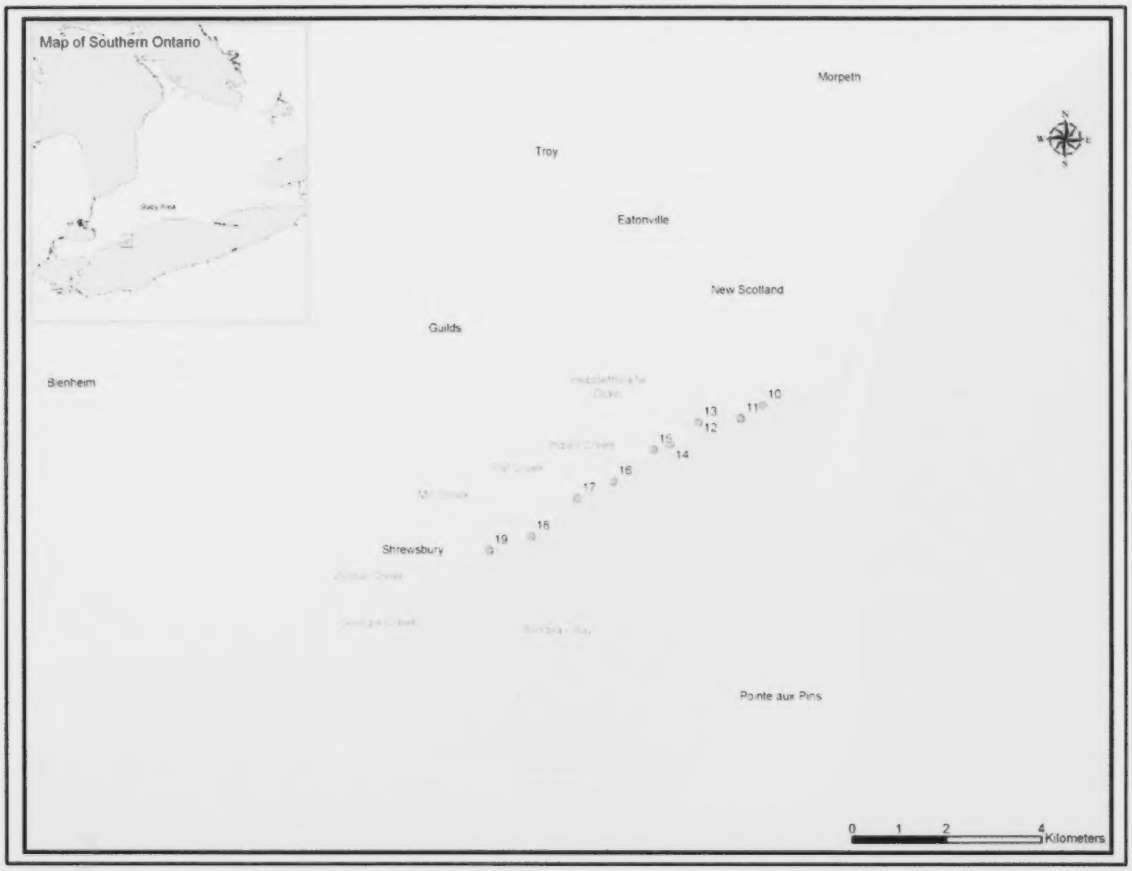

Figure 2.3 – Sites sampled at Rondeau Bay for spotted gar in 2002. See Appendix 2.1 for more detailed site descriptions

Map Legend:

Number on Map	Field Number	Latitude	Longitude	Waterbody Name
10	SPGR02-ROND-001	42.33077	-81.85971	Rondeau Bay
11	SPGR02-ROND-002	42.32819	-81.86391	Rondeau Bay
12	SPGR02-ROND-003	42.32743	-81.87202	Rondeau Bay
13	SPGR02-ROND-004	42.32743	-81.87202	Rondeau Bay
14	SPGR02-ROND-005	42.32337	-81.87742	Rondeau Bay
15	SPGR02-ROND-006	42.32220	-81.88051	Rondeau Bay
16	SPGR02-ROND-007	42.31617	-81.88820	Rondeau Bay
17	SPGR02-ROND-008	42.31286	-81.89514	Rondeau Bay
18	SPGR02-ROND-009	42.30560	-81.90401	Rondeau Bay
19	SPGR02-ROND-010	42.30293	-81.91211	Rondeau Bay

Figure 2.4 – Sites sampled at Point Pelee National Park for spotted gar in 2002. See Appendix 2.1 for more detailed site descriptions.

Map Legend:

Number on Map	Field Number	Latitude	Longitude	Waterbody Name
20	SPGR02-PPNP-SCP-001	41.97972	-82.54139	Sanctuary pond
21	SPGR02-PPNP-SCP-002	41.98556	-82.54333	Sanctuary pond
22	SPGR02-PPNP-LAP-001	41.96750	-82.50361	Lake pond
23	SPGR02-PPNP-LAP-002	41.95944	-82.50833	Lake pond
24	SPGR02-PPNP-LAP-003	41.96750	-82.50361	Lake pond
25	SPGR02-PPNP-LAP-004	41.96000	-82.50500	Lake pond
26	SPGR02-PPNP-LAP-005	41.96444	-82.51194	Lake pond
27	SPGR02-PPNP-LAP-006	41.96750	-82.50389	Lake pond
28	SPGR02-PPNP-WCR-001	41.98167	-82.51472	West Cranberry

3.0 RESULTS

3.1 FISH ASSEMBLAGE SAMPLING

A total of 509 fishes were captured, representing 37 species using both active and passive methods (Table 2.1). Of these 37 species, four fish SAR, listed by COSEWIC, were detected: bigmouth buffalo (*Ictiobus cyprinellus)*; spotted gar; grass pickerel (*Esox americanus vermiculatus*); and, warmouth (*Lepomis gulosus)* (Table 2.3, Appendix 2.3). Passive sampling gear detected 24 species, including all four fish SAR. Active sampling detected 28 fish species including three fish SAR: bigmouth buffalo, grass pickerel and spotted gar (Table 2.1, Appendix 2.3).

Table 2.1 – Summary of sampling effort for spotted gar in 2002. Data for site 23 were excluded due to lack of effort data.

	Active Sampling Total	Passive Sampling			Passive Sampling Total	Combined Gears Total
		Large Fyke net	Small Fyke net	Trap net		
Total Fish Captured	368	8	73	59	140	508
Species Richness	28	5	16	17	24	37
Fish SAR detected (#)	3	2	4	2	4	4
Total Effort (minutes)	547.9	1330	5038	5707	12075	12622.9
Mean CPUE (fish/hour)	40.3	0.4	0.9	0.6	0.7	2.4

3.2 SPOTTED GAR DETECTION

Spotted gar was collected at 13 sites in this study. Six of these sites were located in PPNP and were sampled using passive methods. The other seven sites with spotted gar were located in Rondeau Bay and were electrofished (Table 2.2). At all but two of these 13 sites, only a single specimen was collected; sites 10 and 19 yielded two and three spotted gar, respectively (Figure 2.3, Appendix 2.3). At one site (Site 23) a group studying turtles in PPNP accidentally captured a single specimen of spotted gar in their gear (SFN). The data for this specimen was included in our study.

Table 2.2 – Summary of sampling success for spotted gar by locations sampled in 2002.

	All	Rondeau Bay	PPNP
Total Captured	16	10	6
Total Effort (min)	12299.7	224.7	12075
CPUE (fish/min)	0.0405	0.04	0.0005

Table 2.3 – Summary of species presence (% of sites) collected during spotted gar sampling in 2002 (Boat electrofishing BEF, Fyke netting large-mesh FNLM, Fyke netting small-mesh FNSM, and Trap netting TN. Scientific and common names according to Nelson *et al.* 2004. COSEWIC status: T-Threatened; SC-Special Concern

Common Name	Scientific Name		Rondeau	PPNP		
			BEF	FNLM	FNSM	TN
alewife	*Alosa pseudoharengus*		5.3	0	0	0
bigmouth buffalo	*Ictiobus cyprinellus*	SC	26.3	0	50	25
black bullhead	*Ameiurus melas*		15.8	0	50	25
black crappie	*Pomoxis nigromaculatus*		0	75	100	100
bluegill	*Lepomis macrochirus*		78.9	100	0	100
bluntnose minnow	*Pimephales notatus*		26.3	0	0	0
bowfin	*Amia calva*		0	0	25	75
brook silverside	*Labidesthes sicculus*		15.8	0	0	0
brown bullhead	*Ameiurus nebulosus*		36.8	0	50	25
bullhead	*Ameiurus* sp.		0	0	50	50
central mudminnow	*Umbra limi*		0	0	25	0
channel catfish	*Ictalurus punctatus*		21.1	0	0	0
common carp	*Cyprinus carpio*		21.1	0	50	50
emerald shiner	*Notropis atherinoides*		5.3	0	0	0
freshwater drum	*Aplodinotus grunniens*		21.1	0	0	0
gizzard shad	*Dorosoma cepedianum*		42.1	0	25	50
golden shiner	*Notemigonus crysoleucas*		31.6	0	25	0
goldfish	*Carassius auratus*		0	0	25	0
grass pickerel	*Esox americanus vermiculatus*	SC	5.3	0	25	0
Iowa darter	*Etheostoma exile*		5.3	0	0	0
largemouth bass	*Micropterus salmoides*		57.9	0	0	25
longnose gar	*Lepisosteus osseus*		10.5	0	0	25
mimic shiner	*Notropis volucellus*		10.5	0	0	0
northern pike	*Esox lucius*		26.3	0	0	50
pumpkinseed	*Lepomis gibbosus*		68.4	0	25	25
redfin shiner	*Lythrurus umbratilis*		5.3	0	0	0
rock bass	*Ambloplites rupestris*		10.5	0	0	0
spottail shiner	*Notropis hudsonius*		15.8	0	0	0
spotted gar	*Lepisosteus oculatus*	T	36.8	100	50	75
sunfish	*Lepomis* sp.		0	100	25	0
tadpole madtom	*Noturus gyrinus*		5.3	0	0	0
warmouth	*Lepomis gulosus*	SC	0	100	25	0
white bass	*Morone chrysops*		0	0	0	25
white crappie	*Pomoxis annularis*		5.3	0	0	0
white perch	*Morone americana*		15.8	0	0	75
yellow bullhead	*Ameiurus natalis*		0	0	0	25
yellow perch	*Perca flavescens*		42.1	0	0	25

4.0 DISCUSSION AND RECOMMENDATIONS

Of the 28 sites sampled in this study, spotted gar was detected at 13 sites. Active sampling (i.e. electrofishing efforts) detected spotted gar at 7 sites, constituting approximately 37% of all actively sampled sites (Table 2.3, Appendix 2.3). Passive sampling methods detected spotted gar at 6 sites, or about 67% of the passively sampled sites (Table 2.3, Appendix 2.3). Spotted gar were captured at 100% of LFN sites (n = 1) 50% of SFN sites (n = 2) and 75% (n = 3) of trap net sites (Table 2.3). Although, it appears that passive sampling methods may be more efficient in collecting spotted gar, these results do not allow us to directly compare the efficiency of active and passive sampling techniques in sampling fish SAR. As only one sampling method (either active or passive) was employed at each site, differences in sampling efficiency may simply be the result of non-random fish SAR distributions and abundance.

However, spotted gar catch per unit effort (CPUE) was about 80 times higher in Rondeau Bay, sampled exclusively by active methods, than it was in PPNP, sampled by passive methods (Table 2.2). These data also seem to indicate the superiority of one sampling technique over the other; however, spotted gar was not detected in any of the Long Point sites, all of which were sampled by active methods. It is likely, therefore, that this result is due to non-random distribution and abundance of spotted gar in the various watershed of southern Ontario. It is possible that the habitats where the Long Point sites were located were not suitable for spotted gar at the time of sampling (Figure 2.2).

Although we can not make any definitive conclusions about the relative efficiency of these two sampling techniques (active versus passive sampling), we can compare the relative effectiveness of each of the passive sampling gear types used at PPNP. The trap net detected the highest number of species (17) of all passive sampling methods, despite its moderate catch per unit effort (CPUE) value of 0.6 fish/hour (Table 2.1). Two of the 4 fish SAR, bigmouth buffalo and spotted gar, were detected using a trap net. Small-mesh fyke net sampling detected the second highest number of species (16) but had a high CPUE of 0.9 fish/hour (Table 2.1). Since all four fish SAR were detected by small-mesh fyke net methods, this may be considered the most successful method. Large-mesh fyke net seems to be the poorest passive method of fish SAR detection because it only detected 5 species and had a low CPUE (0.4 fish/hour). It can be argued, however, that since this method was only used on one site and still managed to detect 2 of 4 fish SAR, including the targeted species, spotted gar, large-mesh fyke net may prove to be an effective SAR sampling method.

5.0 ACKNOWLEDGEMENTS

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Appendix 1.1 – Descriptions of sites sampled for black redhorse in 2002.

Map #	Field Number	Latitude	Longitude	Waterbody Name	Site Description
1	MOXD02-NTR-001	43.1889	-80.44	Nith River	Downstream of highway 136, Bishops Gate Rd.
2	MOXD02-NTR-002	43.1892	-80.441	Nith River	Upstream of Bishops Gate Rd.
3	MOXD02-NTR-003	43.1962	-80.468	Nith River	Upstream of Canning Rd. south of the hamlet of Canning
4	MOXD02-NTR-004	43.2962	-80.484	Nith River	na
5	MOXD02-NTR-005	43.2966	-80.483	Nith River	Downstream of Tresslers Rd.; NW from the town of Ayr
6	MOXD02-NTR-006	43.2841	-80.463	Nith River	Old bridge site; within town of Ayr
7	MOXD02-NTR-007	43.2886	-80.47	Nith River	West of Ayr; access through public parkland
8	MOXD02-NTR-008	43.2958	-80.484	Nith River	Upstream and downstream – city Rd. 136
9	MOXD02-NTR-009	43.2837	-80.463	Nith River	Old bridge site; within town of Ayr
10	MOXD02-NTR-011	43.2742	-80.475	Nith River	SW of Ayr @ Trussler Rd. bridge crossing
11	MOXD02-NTR-012	43.2742	-80.475	Nith River	D/S of Trussler Rd. (Township Line)
12	MOXD02-NTR-013	43.2462	-80.518	Nith River	U/S of Drumbo Rd.
13	MOXD02-NTR-014	43.2842	-80.463	Nith River	Ayr, Ontario, @ old bridge
14	MOXD02-CTR-001	43.5357	-80.573	Conestoga River	Downstream of the road; downstream of dam
15	MOXD02-CTR-002	43.6036	-80.643	Conestoga River	Just NW of Wallenstein
16	MOXD02-THR-001	43.3531	-81.191	Thames River	Fished upstream from bridge (Line 16)
17	MOXD02-THR-002	43.2203	-81.237	Fish Creek	8km west of St. Marys, Blanchard township
18	MOXD02-THR-003	43.0534	-81.296	Medway Creek	Below dam
19	MOXD02-THR-004	43.2484	-81.299	Fish Creek	Perth Rd. 161
20	MOXD02-THR-005	43.0919	-80.987	Middle Thames River	Bridge on Rd. 74 @ 23rd Line
21	MOXD02-THR-006	43.0606	-80.995	Middle Thames River	Thamesford dam
22	MOXD02-THR-007	43.0633	-81.08	Waubuno Creek	5km east of London city limit
23	MOXD02-BOC-001	42.6644	-80.805	Big Otter Creek	Approximately 3km upstream of the mouth, between Vienna and Port Burwell
24	MOXD02-BOC-002	42.6788	-80.79	Big Otter Creek	Between east and south bridges within Vienna, Hwy 19, Bayham Twp.

Appendix 1.1 – Continued.

Map #	Field Number	Latitude	Longitude	Waterbody Name	Site Description
25	MOXD02-BOC-003	42.6734	-80.791	Big Otter Creek	Downstream of Vienna
26	MOXD02-BOC-004	42.677	-80.793	Big Otter Creek	Downstream of Vienna
27	MOXD02-CTC-001	42.6615	-81.015	Catfish Creek	Downstream of highway, at mouth
28	MOXD02-CTC-002	42.6627	-81.029	Catfish Creek	Catfish Creek
29	MOXD02-CTC-003	42.6633	-81.023	Catfish Creek	na
30	MOXD02-CTC-004	42.6567	-81.007	Catfish Creek	na
31	MOXD02-CTC-005	42.7025	-81.046	Catfish Creek	Upstream of Sparta Line bridge
32	MOXD02-CTC-006	42.7453	-81.034	Catfish Creek	Below Springwater CA dam
33	MOXD02-CTC-007	42.732	-81.059	Catfish Creek	Downstream of John Wise Line
34	MOXD02-CTC-008	42.7217	-81.057	Catfish Creek	Upstream of Pleasant Valley Line
35	MOXD02-MTR-001	43.775	-81.54	Belgrave Creek	At bridge west of Auburn on Blythe Rd.
36	MOXD02-MTR-002	43.7178	-81.627	Maitland River	Maitland River at mouth of Sharpes Creek in Benmiller,
37	MOXD02-MTR-003	43.7525	-81.7	Maitland River	Bridge on Hwy. 21 in Goderich
38	MOXD02-BFR-001	43.5724	-81.676	Bayfield River	Wildwood Line at Wildwood campground
39	MOXD02-GRD-001	43.1363	-80.268	Grand River	Downstream and upstream of train trestle in Brantford
40	MOXD02-GRD-002	43.4822	-80.48	Grand River	Downstream from Bridgeport
41	MOXD02-GRD-003	43.5722	-80.484	Grand River	Old bridge downstream of West Montrose
42	MOXD02-GRD-004	43.5859	-80.477	Grand River	West Montrose
43	MOXD02-GRD-005	43.6221	-80.448	Grand River	8th Line bridge upstream of West Montrose
44	MOXD02-GRD-006	43.1099	-80.245	Grand River	Cockshutt bridge
45	MOXD02-GRD-007	43.5721	-80.484	Grand River	West Montrose, upstream of old bridge

Appendix 1.2a – Species collected by boat electrofishing at black redhorse sites sampled in 2002.

		Number on Map									
Species List	**Total (BEF+BPEF)**	**1**	**2**	**3**	**5**	**23**	**24**	**25**	**26**	**31**	**33**
Ambloplites rupestris	**29**	1	1			2	2	1		1	
Ameiurus nebulosus	**4**										
Aplodinotus grunniens	**12**					3	3	3			
Campostoma anomalum	**7**										
Carpiodes cyprinus	**3**					1	1				
Catostomus commersonii	**44**	5	4			3	3	5		1	1
Cottus bairdii	**2**										
Cyprinella spiloptera	**23**					3	3	7	4	2	
Cyprinus carpio	**28**						10+	10+			1
Dorosoma cepedianum	**45**					6	6	10+		1	
Esox lucius	**1**										
Etheostoma blennioides	**88**	7	26	2	26						
Etheostoma caeruleum	**100**	13	31	13	24						
Etheostoma flabellare	**4**										
Etheostoma microperca	**1**										
Etheostoma nigrum	**14**		1		4					1	
Hypentelium nigricans	**31**	1	2	1	8					1	1
Ictalurus punctatus	**15**					3	3	1	1		1
Lepisosteus osseus	**2**										
Lepomis cyanellus	**2**									1	1
Lepomis gibbosus	**5**										
Lepomis macrochirus	**2**										
Lepomis megalotis	**6**										
Luxilus chrysocephalus	**26**			1		3	2				
Luxilus cornutus	**80**	1	16	12	8	5	6	4	1	1	1
Margariscus margarita	**1**										
Micropterus dolomieu	**24**	1			1					1	1
Micropterus salmoides	**4**										
Moxostoma anisurum	**24**					4	4	1	6		
Moxostoma duquesnei	**80**										
Moxostoma erythrurum	**55**	1				1	1	5	1		
Moxostoma macrolepidotum	**37**					1	1			1	
Moxostoma valenciennesi	**29**										
Neogobius melanostomus	**1**										
Nocomis biguttatus	**16**				1						
Nocomis micropogon	**13**		4	2							
Nocomis spp.	**1**				1						

Appendix 1.2a – Continued.

		Number On Map									
Species List	**Total (BEF+BPEF)**	**1**	**2**	**3**	**5**	**23**	**24**	**25**	**26**	**31**	**33**
Notemigonus crysoleucas	**2**										
Notropis atherinoides	**3**							1	2		
Notropis heterolepis	**1**										
Notropis hudsonius	**2**							2			
Notropis rubellus	**25**		1	1	3						
Notropis sp.	**1**						1				
Notropis volucellus	**33**		1	3		1					
Noturus flavus	**12**				4						1
Oncorhynchus mykiss	**1**										
Oncorhynchus tshawytscha	**1**										
Perca flavescens	**3**										
Percina caprodes	**1**										
Percina maculata	**29**	1	6	2	11						1
Pimephales notatus	**30**		1			1					
Pomoxis nigromaculatus	**2**										
Rhinichthys atratulus	**4**				1						
Rhinichthys cataractae	**44**		19	9	7						
Salvelinus fontinalis	**1**										
Semotilus atromaculatus	**17**				7					1	1

Appendix 1.2b – Species collected by backpack electrofishing at black redhorse sites sampled in 2002.

		Number on Map																	
Species List	**Total (BEF+BPEF)**	**4**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**
Ambloplites rupestris	**29**										1		1	1	1	1	1	1	1
Ameiurus nebulosus	**4**																		
Aplodinotus grunniens	**12**																		
Campostoma anomalum	**7**											1	1	1		1	1		1
Carpiodes cyprinus	**3**																		
Catostomus commersonii	**44**	1							1		1	2		1	1	1	1	1	1
Cottus bairdii	**2**																		
Cyprinella spiloptera	**23**													1		1			
Cyprinus carpio	**28**								1						1				
Dorosoma cepedianum	**45**																		
Esox lucius	**1**														1				
Etheostoma blennioides	**88**	2	1				2				1		2	4	1	1	1	1	1
Etheostoma caeruleum	**100**	1	1	3			1		1		1								
Etheostoma flabellare	**4**																		1
Etheostoma microperca	**1**																1		
Etheostoma nigrum	**14**	1					1							1			1		1
Hypentelium nigricans	**31**			2			1		1				1		1	1	1	1	1
Ictalurus punctatus	**15**																		
Lepisosteus osseus	**2**																		
Lepomis cyanellus	**2**																		
Lepomis gibbosus	**5**																1	1	
Lepomis macrochirus	**2**																		
Lepomis megalotis	**6**													1	1	2			
Luxilus chrysocephalus	**26**								3				5			1	3	1	
Luxilus cornutus	**80**	4	5	2					3		1				2	1			2
Margariscus margarita	**1**											1							
Micropterus dolomieu	**24**			1								1	1		1		1	1	
Micropterus salmoides	**4**																	1	
Moxostoma anisurum	**24**																		
Moxostoma duquesnei	**80**		3			3		3			1				6		1		

Appendix 1.2b – Continued.

Species List	Total (BEF+BPEF)	Number on Map																	
		4	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
Moxostoma erythrurum	**55**						5	1						11	10				
Moxostoma macrolepidotum	**37**		1				3			2									
Moxostoma valenciennesi	**29**	2	4		2	4		7			1								
Neogobius melanostomus	**1**																		
Nocomis biguttatus	**16**		3				1				1	1					2		
Nocomis micropogon	**13**		1									1						1	
Nocomis sp.	**1**																		
Notemigonus crysoleucas	**2**																		
Notropis atherinoides	**3**																		
Notropis heterolepis	**1**																		
Notropis hudsonius	**2**																		
Notropis rubellus	**25**	6		6			1						1					1	1
Notropis sp.	**1**																		
Notropis volucellus	**33**	3					3		8										
Noturus flavus	**12**										1								
Oncorhynchus mykiss	**1**																		
Oncorhynchus tshawytscha	**1**																		
Perca flavescens	**3**										1								
Percina caprodes	**1**																		
Percina maculata	**29**	1					1							1					
Pimephales notatus	**30**								13				1	2		1	2	1	1
Pomoxis nigromaculatus	**2**																		
Rhinichthys atratulus	**4**											1							1
Rhinichthys cataractae	**44**			4					1		1								
Salvelinus fontinalis	**1**																		
Semotilus atromaculatus	**17**	1									1		1			1			1

Appendix 1.2b – Species collected by backpack electrofishing at black redhorse sites sampled in 2002 continued.

		Number on Map																
Species List	**Total (BEF+BPEF)**	**27**	**28**	**29**	**30**	**32**	**34**	**35**	**36**	**37**	**38**	**39**	**40**	**41**	**42**	**43**	**44**	**45**
Ambloplites rupestris	**29**	1		1		1	1	1	1	1	1	3	1					1
Ameiurus nebulosus	**4**				4													
Aplodinotus grunniens	**12**	1			2													
Campostoma anomalum	**7**								1									
Carpiodes cyprinus	**3**		1															
Catostomus commersonii	**44**					1	1	1	1			5	1					1
Cottus bairdii	**2**								2									
Cyprinella spiloptera	**23**						1					1						
Cyprinus carpio	**28**					1		2				1	1					
Dorosoma cepedianum	**45**	9		3	10													
Esox lucius	**1**																	
Etheostoma blennioides	**88**										1	6	2					1
Etheostoma caeruleum	**100**							1	2	1	2	3	1					1
Etheostoma flabellare	**4**								1									2
Etheostoma microperca	**1**																	
Etheostoma nigrum	**14**											2	1					
Hypentelium nigricans	**31**						1		1		1	2	1					1
Ictalurus punctatus	**15**	2	2	2														
Lepisosteus osseus	**2**		1	1														
Lepomis cyanellus	**2**																	
Lepomis gibbosus	**5**	1				1												1
Lepomis macrochirus	**2**		1			1												
Lepomis megalotis	**6**							1	1									
Luxilus chrysocephalus	**26**							1	2		1	3						
Luxilus cornutus	**80**						1		1				1					2
Margariscus margarita	**1**																	
Micropterus dolomieu	**24**	4		1	1		1	1	1	1	1	1	1					1
Micropterus salmoides	**4**			1		1							1					
Moxostoma anisurum	**24**	1	2	2												4		
Moxostoma duquesnei	**80**							4	3	1				2	46	2	5	
Moxostoma erythrurum	**55**		3	2			1								1		12	

Appendix 1.2b – Continued.

Species List	Total (BEF+BPEF)	27	28	29	30	32	34	35	36	37	38	39	40	41	42	43	44	45
Moxostoma macrolepidotum	**37**															28		
Moxostoma valenciennesi	**29**														1	7		1
Neogobius melanostomus	**1**									1								
Nocomis biguttatus	**16**							3			1	1	1					1
Nocomis micropogon	**13**								1	1			1					1
Nocomis sp.	**1**																	
Notemigonus crysoleucas	**2**				1	1												
Notropis atherinoides	**3**																	
Notropis heterolepis	**1**								1									
Notropis hudsonius	**2**																	
Notropis rubellus	**25**							1		2		1						
Notropis sp.	**1**																	
Notropis volucellus	**33**											14						
Noturus flavus	**12**						1				1	1	2					1
Oncorhynchus mykiss	**1**								1									
Oncorhynchus tshawytscha	**1**								1									
Perca flavescens	**3**			1		1												
Percina caprodes	**1**											1						
Percina maculata	**29**							1				3						1
Pimephales notatus	**30**	2				2					1	1	1					
Pomoxis nigromaculatus	**2**				1	1												
Rhinichthys atratulus	**4**																	1
Rhinichthys cataractae	**44**								1			1	1					
Salvelinus fontinalis	**1**								1									
Semotilus atromaculatus	**17**		1			1												1

Appendix 1.3 – Summary of effort by site for black redhorse sites sampled in 2002.

# On Map	Field Number	Method	Effort	Effort Units	Description of Method
1	MOXD02-NTR-001	BoatEF	933	seconds	SAR, 14' Efishing Boat (LOWE), 5.0 kW, single boom
2	MOXD02-NTR-002	BoatEF	1613	seconds	SAR, 14' Efishing Boat (LOWE), 5.0 kW, single boom
3	MOXD02-NTR-003	BoatEF	1013	seconds	SAR, 14' Efishing Boat (LOWE), 5.0 kW, single boom
4	MOXD02-NTR-004	BackpackEF	835	seconds	Smith Root LR 24 Backpack Unit
5	MOXD02-NTR-005	BoatEF	1198	seconds	SAR, 14' Efishing Boat (LOWE), 5.0 kW, single boom
6	MOXD02-NTR-006	BackpackEF	688	seconds	Smith Root LR 24 Backpack Unit
7	MOXD02-NTR-007	BackpackEF	NA	seconds	Smith Root LR 24 Backpack Unit
8	MOXD02-NTR-008	BackpackEF	NA	seconds	Smith Root LR 24 Backpack Unit
9	MOXD02-NTR-009	BackpackEF	688	seconds	Smith Root LR 24 Backpack Unit
10	MOXD02-NTR-011	BackpackEF	NA	seconds	Smith Root LR 24 Backpack Unit
11	MOXD02-NTR-012	BackpackEF	NA	seconds	Smith Root LR 24 Backpack Unit
12	MOXD02-NTR-013	BackpackEF	NA	seconds	Smith Root LR 24 Backpack Unit
13	MOXD02-NTR-014	BackpackEF	NA	seconds	Smith Root LR 24 Backpack Unit
14	MOXD02-CTR-001	BackpackEF	2800	seconds	Smith Root LR 24 Backpack Unit
15	MOXD02-CTR-002	BackpackEF	968	seconds	Smith Root LR 24 Backpack Unit
16	MOXD02-THR-001	BackpackEF	1876	seconds	Smith Root LR 24 Backpack Unit
17	MOXD02-THR-002	BackpackEF	1521	seconds	Smith Root LR 24 Backpack Unit
18	MOXD02-THR-003	BackpackEF	1547	seconds	Smith Root LR 24 Backpack Unit
19	MOXD02-THR-004	BackpackEF	1097	seconds	Smith Root LR 24 Backpack Unit
20	MOXD02-THR-005	BackpackEF	1161	seconds	Smith Root LR 24 Backpack Unit
21	MOXD02-THR-006	BackpackEF	465	seconds	Smith Root LR 24 Backpack Unit
22	MOXD02-THR-007	BackpackEF	1108	seconds	Smith Root LR 24 Backpack Unit
23	MOXD02-BOC-001	BoatEF	1040	seconds	SAR, 14' Efishing Boat (LOWE), 5.0 kW, single boom
24	MOXD02-BOC-002	BoatEF	1040	seconds	SAR, 14' Efishing Boat (LOWE), 5.0 kW, single boom
25	MOXD02-BOC-003	BoatEF	1101	seconds	SAR, 14' Efishing Boat (LOWE), 5.0 kW, single boom
26	MOXD02-BOC-004	BoatEF	929	seconds	SAR, 14' Efishing Boat (LOWE), 5.0 kW, single boom
27	MOXD02-CTC-001	BackpackEF	1016	seconds	Smith Root LR 24 Backpack Unit
28	MOXD02-CTC-002	BackpackEF	380	seconds	Smith Root LR 24 Backpack Unit
29	MOXD02-CTC-003	BackpackEF	1038	seconds	Smith Root LR 24 Backpack Unit
30	MOXD02-CTC-004	BackpackEF	939	seconds	Smith Root LR 24 Backpack Unit
31	MOXD02-CTC-005	BoatEF	960	seconds	SAR, 14' Efishing Boat (LOWE), 5.0 kW, single boom

Appendix 1.3 – Continued.

# on Map	Field Number	Method	Effort	Effort Units	Description of Method
32	MOXD02-CTC-006	BackpackEF	2174	seconds	Smith Root LR 24 Backpack Unit
33	MOXD02-CTC-007	BoatEF	981	seconds	SAR, 14' Efishing Boat (LOWE), 5.0 kW, single boom
34	MOXD02-CTC-008	BackpackEF	968	seconds	Smith Root LR 24 Backpack Unit
35	MOXD02-MTR-001	BackpackEF	986	seconds	Smith Root LR 24 Backpack Unit
36	MOXD02-MTR-002	BackpackEF	1436	seconds	Smith Root LR 24 Backpack Unit
37	MOXD02-MTR-003	BackpackEF	1148	seconds	Smith Root LR 24 Backpack Unit
38	MOXD02-BFR-001	BackpackEF	937	seconds	Smith Root LR 24 Backpack Unit
39	MOXD02-GRD-001	BackpackEF	NA	seconds	Smith Root LR 24 Backpack Unit
40	MOXD02-GRD-002	BackpackEF	4300	seconds	Smith Root LR 24 Backpack Unit
41	MOXD02-GRD-003	BackpackEF	NA	seconds	Smith Root LR 24 Backpack Unit
42	MOXD02-GRD-004	BackpackEF	NA	seconds	Smith Root LR 24 Backpack Unit
43	MOXD02-GRD-005	BackpackEF	2675	seconds	Smith Root LR 24 Backpack Unit
44	MOXD02-GRD-006	BackpackEF	1512	seconds	Smith Root LR 24 Backpack Unit
45	MOXD02-GRD-007	BackpackEF	4100	seconds	Smith Root LR 24 Backpack Unit

Appendix 1.4 – Habitat data for black redhorse sites sampled in 2002.

# on Map	Field Number	Air Temp (°C)	Water Temp (°C)	COND (µS)	Turbidity (m)	Max Stream Depth (m)
1	MOXD02-NTR-001	29.0	26.0	NA	NA	NA
2	MOXD02-NTR-002	29.0	26.0	NA	NA	NA
3	MOXD02-NTR-003	29.0	28.0	NA	NA	NA
4	MOXD02-NTR-004	28.0	27.0	635	NA	NA
5	MOXD02-NTR-005	25.0	26.6	686	NA	NA
6	MOXD02-NTR-006	26.0	27.0	706	NA	NA
7	MOXD02-NTR-007	26.3	28.7	690	NA	NA
8	MOXD02-NTR-008	NA	NA	NA	NA	NA
9	MOXD02-NTR-009	26.0	27.0	706	NA	NA
10	MOXD02-NTR-011	15.2	19.2	728	0	0.5 - 0.75
11	MOXD02-NTR-012	15.2	19.2	728	0	0.5-1.2
12	MOXD02-NTR-013	NA	NA	NA	NA	NA
13	MOXD02-NTR-014	NA	NA	NA	NA	NA
14	MOXD02-CTR-001	24.4	23.6	464	NA	NA
15	MOXD02-CTR-002	25.0	15.0	NA	SLIGHTLY TURBID	NA
16	MOXD02-THR-001	28.0	22.0	NA	TURBID 3" VISIBILITY	NA
17	MOXD02-THR-002	32.0	25.0	NA	TURBID, 6" VISIBILITY	NA
18	MOXD02-THR-003	25.0	NA	NA	SLIGHTLY TURBID	NA
19	MOXD02-THR-004	25.0	28.0	NA	TURBID	NA
20	MOXD02-THR-005	30.0	24.0	NA	TURBID	NA
21	MOXD02-THR-006	25.0	24.0	NA	SLIGHTLY TURBID	NA
22	MOXD02-THR-007	32.0	27.0	NA	CLEAR/SLIGHTLY TURBID	NA
23	MOXD02-BOC-001	31.0	24.2	577	NA	NA
24	MOXD02-BOC-002	NA	NA	NA	NA	NA
25	MOXD02-BOC-003	NA	NA	NA	NA	NA
26	MOXD02-BOC-004	NA	NA	NA	NA	NA
27	MOXD02-CTC-001	26.1	26.6	565	NA	NA
28	MOXD02-CTC-002	26.1	26.6	565	TURBID	NA
29	MOXD02-CTC-003	26.1	26.6	565	TURBID	NA
30	MOXD02-CTC-004	26.1	26.6	565	TURBID	NA

Appendix 1.4 – Continued.

# on Map	Field Number	Air Temp (°C)	Water Temp (°C)	COND (µS)	Turbidity (m)	Max Stream Depth (m)
31	MOXD02-CTC-005	31.0	26.0	NA	TURBID	NA
32	MOXD02-CTC-006	28.0	25.0	NA	TURBID	NA
33	MOXD02-CTC-007	31.0	24.0	NA	TURBID	NA
34	MOXD02-CTC-008	31.0	25.0	NA	TURBID	NA
35	MOXD02-MTR-001	25.0	22.5	NA	CLEAR	NA
36	MOXD02-MTR-002	21.0	22.0	NA	CLEAR	NA
37	MOXD02-MTR-003	23.0	22.0	NA	CLEAR	NA
38	MOXD02-BFR-001	26.0	25.0	NA	SLIGHTLY TURBID	NA
39	MOXD02-GRD-001	NA	NA	NA	NA	NA
40	MOXD02-GRD-002	21.3	20.7	469	NA	NA
41	MOXD02-GRD-003	28.0	24.0	NA	CLEAR	NA
42	MOXD02-GRD-004	NA	NA	NA	NA	NA
43	MOXD02-GRD-005	NA	22.0	385	NA	NA
44	MOXD02-GRD-006	5.9	6.9	902	NA	NA
45	MOXD02-GRD-007	22.3	20.8	454	NA	NA

Appendix 2.1 - Location descriptions for spotted gar sampling in 2002.

# on Map	Field Number	Latitude	Longitude	Datum	Waterbody	Site Description
1	SPGR02-BCMR-001	42.5968	-80.46749	NAD83	Big Creek Marsh	Big Creek delta, Long Point, ON
2	SPGR02-BCMR-002	42.59362	-80.47065	NAD83	Big Creek Marsh	Encroaching the main Big Creek channel, Long Point, ON
3	SPGR02-BCMR-003	42.59694	-80.49005	NAD83	Big Creek Marsh	Upstream of Port Royal bridge, Long Point, ON
4	SPGR02-BCMR-004	42.58931	-80.45493	NAD83	Big Creek Marsh	Southern part of marsh, Long Point, ON
5	SPGR02-BCMR-005	42.59987	-80.4499	NAD83	Big Creek Marsh	Big Creek delta, Long Point, ON
6	SPGR02-OLCT-001	42.59409	-80.39575	NAD83	Old Cut Marsh	Long Point, ON
7	SPGR02-OLCT-002	42.59339	-80.40826	NAD83	Old Cut Marsh	Long Point, ON
8	SPGR02-OLCT-004	42.58384	-80.40697	NAD83	Old Cut Marsh	Long Point, ON
9	SPGR02-OLCT-003	42.58197	-80.4146	NAD83	Old Cut Marsh	Long Point, ON
10	SPGR02-ROND-001	42.33077	-81.85971	NAD83	Rondeau Bay	Mouth of Hebblewaite drain, Rondeau Bay
11	SPGR02-ROND-002	42.32819	-81.86391	NAD83	Rondeau Bay	Rondeau Bay
12	SPGR02-ROND-003	42.32743	-81.87202	NAD83	Rondeau Bay	Rondeau Bay
13	SPGR02-ROND-004	42.32743	-81.87202	NAD83	Rondeau Bay	Rondeau Bay
14	SPGR02-ROND-005	42.32337	-81.87742	NAD83	Rondeau Bay	Rondeau Bay
15	SPGR02-ROND-006	42.3222	-81.88051	NAD83	Rondeau Bay	Rondeau Bay
16	SPGR02-ROND-007	42.31617	-81.8882	NAD83	Rondeau Bay	Rondeau Bay
17	SPGR02-ROND-008	42.31286	-81.89514	NAD83	Rondeau Bay	Rondeau Bay
18	SPGR02-ROND-009	42.3056	-81.90401	NAD83	Rondeau Bay	Rondeau Bay
19	SPGR02-ROND-010	42.30293	81.91211	NAD83	Rondeau Bay	Rondeau Bay
20	SPGR02-PPNP-SCP-001	41.97972	-82.54139	NAD83	Sanctuary Pond	Sanctuary Pond, Point Pelee National Park
21	SPGR02-PPNP-SCP-002	41.98556	-82.54333	NAD83	Sanctuary Pond	Sanctuary Pond, Point Pelee National Park
22	SPGR02-PPNP-LAP-001	41.9675	-82.50361	NAD83	Lake Pond	Northeast corner of Lake Pond, Point Pelee National Park
23	SPGR02-PPNP-LAP-002	41.95944	-82.50833	NAD83	Lake Pond	Point Pelee National Park, incidental catch by turtle research staff
24	SPGR02-PPNP-LAP-003	41.9675	-82.50361	NAD83	Lake Pond	Point Pelee National Park, Northeast corner of Lake Pond at trap net site #3
25	SPGR02-PPNP-LAP-004	41.96	-82.505	NAD83	Lake Pond	Northeast of island in southeast corner of Lake Pond
26	SPGR02-PPNP-LAP-005	41.96444	-82.51194	NAD83	Lake Pond	South shore of Lake Pond, middle set off of a wild rice patch
27	SPGR02-PPNP-LAP-006	41.9675	-82.50389	NAD83	Lake Pond	Northeast corner of Lake Pond
28	SPGR02-PPNP-WCR-001	41.98167	-82.51472	NAD83	West Cranberry	On east shore approximately 800m from northeast bend

Appendix 2.2 – Summary of effort by site for spotted gar sites sampled in 2002.

# on Map	Field Number	Method	Effort	Effort Units	Description of Method
1	SPGR02-BCMR-001	BoatEF	2396	Seconds	SAR, 14' Efishing Boat (LOWE), 5.0 kW, single boom
2	SPGR02-BCMR-002	BoatEF	2063	Seconds	SAR, 14' Efishing Boat (LOWE), 5.0 kW, single boom
3	SPGR02-BCMR-003	BoatEF	2685	Seconds	SAR, 14' Efishing Boat (LOWE), 5.0 kW, single boom
4	SPGR02-BCMR-004	BoatEF	3241	Seconds	SAR, 14' Efishing Boat (LOWE), 5.0 kW, single boom
5	SPGR02-BCMR-005	BoatEF	3104	Seconds	SAR, 14' Efishing Boat (LOWE), 5.0 kW, single boom
6	SPGR02-OLCT-001	BoatEF	1236	Seconds	SAR, 14' Efishing Boat (LOWE), 5.0 kW, single boom
7	SPGR02-OLCT-002	BoatEF	1553	Seconds	SAR, 14' Efishing Boat (LOWE), 5.0 kW, single boom
8	SPGR02-OLCT-003	BoatEF	1480	Seconds	SAR, 14' Efishing Boat (LOWE), 5.0 kW, single boom
9	SPGR02-OLCT-004	BoatEF	1630	Seconds	SAR, 14' Efishing Boat (LOWE), 5.0 kW, single boom
10	SPGR02-ROND-001	BoatEF	1203	Seconds	SAR, 14' Efishing Boat (LOWE), 5.0 kW, single boom
11	SPGR02-ROND-002	BoatEF	2411	Seconds	SAR, 14' Efishing Boat (LOWE), 5.0 kW, single boom
12	SPGR02-ROND-003	BoatEF	3686	Seconds	SAR, 14' Efishing Boat (LOWE), 5.0 kW, single boom
13	SPGR02-ROND-004	BoatEF	891	Seconds	SAR, 14' Efishing Boat (LOWE), 5.0 kW, single boom
14	SPGR02-ROND-005	BoatEF	774	Seconds	SAR, 14' Efishing Boat (LOWE), 5.0 kW, single boom
15	SPGR02-ROND-006	BoatEF	581	Seconds	SAR, 14' Efishing Boat (LOWE), 5.0 kW, single boom
16	SPGR02-ROND-007	BoatEF	941	Seconds	SAR, 14' Efishing Boat (LOWE), 5.0 kW, single boom
17	SPGR02-ROND-008	BoatEF	565	Seconds	SAR, 14' Efishing Boat (LOWE), 5.0 kW, single boom
18	SPGR02-ROND-009	BoatEF	443.00	Seconds	SAR, 14' Efishing Boat (LOWE), 5.0 kW, single boom
19	SPGR02-ROND-010	BoatEF	1988	Seconds	SAR, 14' Efishing Boat (LOWE), 5.0 kW, single boom
20	SPGR02-PPNP-SCP-001	Fyke net, small	22.17	Hours	Fyke net small, 1/4" mesh
21	SPGR02-PPNP-SCP-002	Fyke net, small	20.21	Hours	Fyke net small, 1/4" mesh
22	SPGR02-PPNP-LAP-001	Trap net	21.50	Hours	Trap net
23	SPGR02-PPNP-LAP-002	Fyke net, small	NA	NA	Fyke net small, 1/4" mesh
24	SPGR02-PPNP-LAP-003	Trap net	26.18	Hours	Trap net
25	SPGR02-PPNP-LAP-004	Trap net	21.45	Hours	Trap net
26	SPGR02-PPNP-LAP-005	Fyke net, large	22.10	Hours	Fyke net large, 1" mesh
27	SPGR02-PPNP-LAP-006	Trap net	25.14	Hours	Trap net
28	SPGR02-PPNP-WCR-001	Fyke net, small	20.5	Hours	Fyke net small, 1/4" mesh

Appendix 2.3a – Species collected by active sampling at spotted gar sites sampled in 2002. Scientific and common names according to Nelson *et al.* 2004.

			Number on Map								
Common Name	**Scientific Name**	**Total**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
alewife	*Alosa pseudoharengus*	**1**	1								
bigmouth buffalo	*Ictiobus cyprinellus*	**0**									
black bullhead	*Ameiurus melas*	**6**			1		1	4			
bluegill	*Lepomis macrochirus*	**74**	6	5	2	9	9	7	14	13	9
bluntnose minnow	*Pimephales notatus*	**8**	1				1	1	5		
brook silverside	*Labidesthes sicculus*	**2**					1				1
brown bullhead	*Ameiurus nebulosus*	**25**	1		1	7	6		7	1	2
channel catfish	*Ictalurus punctatus*	**0**									
common carp	*Cyprinus carpio*	**2**		1			1				
emerald shiner	*Notropis atherinoides*	**0**									
freshwater drum	*Aplodinotus grunniens*	**3**		1	1						1
gizzard shad	*Dorosoma cepedianum*	**5**	3	1		1					
golden shiner	*Notemigonus crysoleucas*	**6**	1		1		1		1	1	1
grass pickerel	*Esox americanus vermiculatus*	**1**			1						
Iowa darter	*Etheostoma exile*	**1**						1			
largemouth bass	*Micropterus salmoides*	**9**	2			1	2	2	1		1
longnose gar	*Lepisosteus osseus*	**0**									
mimic shiner	*Notropis volucellus*	**9**						6	3		
northern pike	*Esox lucius*	**8**		2	1	1		1			3
pumpkinseed	*Lepomis gibbosus*	**44**	11	4	6	10	5		2	5	1
redfin shiner	*Lythrurus umbratilis*	**0**									
rock bass	*Ambloplites rupestris*	**4**	2			2					
spottail shiner	*Notropis hudsonius*	**0**									
spotted gar	*Lepisosteus oculatus*	**0**									
tadpole madtom	*Noturus gyrinus*	**1**						1			
white bass	*Morone americana*	**0**									
white crappie	*Pomoxis annularis*	**0**									
yellow perch	*Perca flavescens*	**49**	6			12	8	7	10	5	1

Appendix 2.3a – Continued.

			Number on Map									
Common Name	**Scientific Name**	**Total**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**
alewife	*Alosa pseudoharengus*	**1**										
bigmouth buffalo	*Ictiobus cyprinellus*	**7**				1			1	2	2	1
black bullhead	*Ameiurus melas*	**6**										
bluegill	*Lepomis macrochirus*	**82**	1	1	3			1		1		1
bluntnose minnow	*Pimephales notatus*	**9**	1									
brook silverside	*Labidesthes sicculus*	**3**			1							
brown bullhead	*Ameiurus nebulosus*	**25**										
channel catfish	*Ictalurus punctatus*	**6**	2			1				1	2	
common carp	*Cyprinus carpio*	**4**			1						1	
emerald shiner	*Notropis atherinoides*	**2**	2									
freshwater drum	*Aplodinotus grunniens*	**4**							1			
gizzard shad	*Dorosoma cepedianum*	**43**	16	15	5						1	1
golden shiner	*Notemigonus crysoleucas*	**6**										
grass pickerel	*Esox americanus vermiculatus*	**1**										
lowa darter	*Etheostoma exile*	**1**										
largemouth bass	*Micropterus salmoides*	**20**		4	2	2		2				1
longnose gar	*Lepisosteus osseus*	**3**						2	1			
mimic shiner	*Notropis volucellus*	**9**										
northern pike	*Esox lucius*	**8**										
pumpkinseed	*Lepomis gibbosus*	**54**	6	1				1		1		1
redfin shiner	*Lythrurus umbratilis*	**1**	1									
rock bass	*Ambloplites rupestris*	**4**										
spottail shiner	*Notropis hudsonius*	**3**	1	1							1	
spotted gar	*Lepisosteus oculatus*	**10**	2	1		1	1			1	1	3
tadpole madtom	*Noturus gyrinus*	**1**										
white bass	*Morone americana*	**4**			1		2			1		
white crappie	*Pomoxis annularis*	**1**					1					
yellow perch	*Perca flavescens*	**50**	1									

Appendix 2.3b – Species collected by passive sampling at spotted gar sites sampled in 2002. Scientific and common names according to Nelson *et al.* 2004.

			Number on Map								
Common Name	**Scientific Name**	**Total**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**
bigmouth buffalo	*Ictiobus cyprinellus*	**3**	1	1	1						
black bullhead	*Ameiurus melas*	**3**	1	1				1			
black crappie	*Pomoxis nigromaculatus*	**47**	2	6	8		6	2	3	18	2
bluegill	*Lepomis macrochirus*	**14**			5		1	1	1	6	
bowfin	*Amia calva*	**12**	2		2		4	4			
brown bullhead	*Ameiurus nebulosus*	**11**	5	5				1			
bullhead	*Ameiurus* sp.	**4**	3								1
central mudminnow	*Umbra limi*	**4**	4								
common carp	*Cyprinus carpio*	**8**	4	2			1			1	
gizzard shad	*Dorosoma cepedianum*	**6**					2			1	3
golden shiner	*Notemigonus crysoleucas*	**1**		1							
goldfish	*Carassius auratus*	**3**	3								
grass pickerel	*Esox americanus vermiculatus*	**1**	1								
largemouth bass	*Micropterus salmoides*	**1**			1						
longnose gar	*Lepisosteus osseus*	**1**			1						
northern pike	*Esox lucius*	**3**					2	1			
pumpkinseed	*Lepomis gibbosus*	**2**		1						1	
spotted gar	*Lepisosteus oculatus*	**6**				1	1	1	1	1	1
sunfish	*Lepomis* sp.	**5**							2		3
warmouth	*Lepomis gulosus*	**2**							1		1
white bass	*Morone chrysops*	**1**					1				
white perch	*Morone americana*	**2**			1					1	
yellow bullhead	*Ameiurus natalis*	**1**					1				
yellow perch	*Perca flavescens*	**1**								1	

Appendix 2.4 – Habitat data for spotted gar sites sampled in 2002.

# on Map	Field Number	Air Temp (°C)	Water Temp (°C)	Stream Width (m)	Max Stream Depth (m)	Substrate Notes
1	SPGR02-BCMR-001	NA	NA	NA	NA	NA
2	SPGR02-BCMR-002	NA	NA	NA	NA	NA
3	SPGR02-BCMR-003	28	NA	NA	NA	NA
4	SPGR02-BCMR-004	25	19	NA	NA	NA
5	SPGR02-BCMR-005	NA	NA	NA	NA	NA
6	SPGR02-OLCT-001	25	21	NA	NA	NA
7	SPGR02-OLCT-002	NA	NA	NA	NA	NA
8	SPGR02-OLCT-003	23	28	NA	NA	NA
9	SPGR02-OLCT-004	28	22	NA	NA	NA
10	SPGR02-ROND-001	27	22	NA	NA	MURKY AND MUDDY
11	SPGR02-ROND-002	27	22	NA	NA	MURKY
12	SPGR02-ROND-003	28	19	NA	NA	NA
13	SPGR02-ROND-004	NA	NA	NA	NA	NA
14	SPGR02-ROND-005	30	21	NA	NA	NA
15	SPGR02-ROND-006	33	21	NA	NA	NA
16	SPGR02-ROND-007	32	25	NA	NA	NA
17	SPGR02-ROND-008	NA	NA	NA	NA	NA
18	SPGR02-ROND-009	NA	NA	NA	NA	NA
19	SPGR02-ROND-010	NA	NA	NA	NA	NA
20	SPGR02-PPNP-SCP-001	28	27	5	0.9	MUCK
21	SPGR02-PPNP-SCP-002	28	27	5	0.9	MUCK
22	SPGR02-PPNP-LAP-001	24	26.5	0	0.1	MUCK
23	SPGR02-PPNP-LAP-002	NA	NA	NA	NA	NA
24	SPGR02-PPNP-LAP-003	24	22	0	2	85% MUCK, 15% SAND
25	SPGR02-PPNP-LAP-004	26	25	NA	2	SILT MUCK 65%, SAND 30% GRAVEL 5%
26	SPGR02-PPNP-LAP-005	25	24	11	2	100% SILT/MUCK
27	SPGR02-PPNP-LAP-006	18	20	NA	2	10% SAND, SILT/MUCK 90%
28	SPGR02-PPNP-WCR-001	25	24	NA	2	100% SILT/MUCK